On the Profitability of Momentum Strategies and Relative Strength Indexes in the International Equity Markets

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Abstract

Chan, Hameed and Tong (2000) found that the momentum strategies generate significant positive profits for international equity markets. Their results, however, do not take transaction costs into account. This paper re-examines the profitability of their trading rules after the deduction of transaction costs. It is found that the net momentum profits become significantly negative once a trivial transaction cost is incorporated. We also study the profitability of the Relative Strength Index (RSI) trading rule. It is found that RSI strategies generate significantly positive profits, and perform better than the momentum strategies.

摘要

Chan, Hameed and Tong (2000) 發現，運用動力指標 (Momentum Strategies) 能夠在國際股票市場獲得利潤。但是，他們的驗證並沒有將交易成本計算於文中。本文會運用 Chan, Hameed and Tong (2000) 的動力指標計算方法，並扣除交易成本以審核動力指標的收益性；當扣除交易成本後，動力指標並不能使投資者獲得額外利潤。另外，本文還會研究相對強弱指數 (Relative Strength Indexes) 的收益能力；本文的研究發現，無論有否扣除交易成本，相對強弱指數的表現都比動力指標優勝。

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Chapter One Introduction and Literature Reviews

A number of the studies on momentum strategies found that the strategies yield significant profits. For example, Jegadeesh and Titman (1993) study a variety of strategies by using NYSE and AMEX stocks. They state that if the prices either overreact or underreact to information, then profitable trading strategies that select stocks based on their past returns exist. They also find that the strategy of buying stocks with high returns and selling stocks with poor returns over intermediate horizon earn a profit of about one percent per month. Rouwenhorst (1998) also reports similar results for stocks that traded on the European markets. Chui, Titman and Wei (2000) document that with notable exception of Japan and Korea, momentum profits are also obtained in the Asian markets. Rouwenhorst (1999) finds that momentum strategies earn significant profits on average in a sample of twenty emerging markets. Chan, Hameed and Tong (2000) also indicate the existence of momentum profits on twenty-three international stock markets over 1980-1995 periods.

The study of Chan et al. (2000) does not consider the costs of transaction. This paper will re-examine the methodology of Chan, Hameed and Tong

(2000) to analyze the momentum strategies[1] over a longer and more recent period from 1986 to mid-2002, and test whether investors still earn profits when transaction costs are included. We will then have a comparison of profits between the momentum strategies and the buy-and-hold strategies. Finally, we will evaluate the important sources of momentum strategies by two simple return-generating models.

This paper will also examine the profitability of Relative Strength Indexes (RSI) over the same sample period as momentum strategies from 1986 to mid-2002. RSI strategies are first introduced by Wilder (1978). It is a useful oscillator; it compares the magnitude of a stock or index's recent gains from the magnitude of its recent losses, and then turns that information into a number that ranges from 0 to 100. Murphy (1999) states that the two major problems in constructing a momentum line are the erratic movement often caused by sharp changes in the values being dropped off and the lack of constant range for comparison purposes. The RSI formula can solve these problems by providing the necessary smoothing and creating a constant vertical range of 0 to 100. However,

[1] According to Pring (1993), momentum can refer to a particular investing or trading style or a leading indicator, which measures a security's rate of change. In this paper, it refers to the later part of its meanings.

there is not much literatures devoted to the study of RSI. The transaction costs are also included in calculating the profits to RSI strategies. We will also evaluate the important sources of RSI strategies by using the same return-generating models as momentum strategies, and the Stochastic Relative Strength Indexes are used to test whether the deficiencies of RSI strategies exist in our portfolio.

The plan of this paper is as follows. The next chapter discusses the calculation of profits from momentum strategies and relative strength indexes. Chapter Three describes the data. Chapter Four reports the empirical findings. Chapter Five concludes and summarizes our results.

Chapter Two Methodology

A. Momentum Strategies

The strategies of Chan, Hameed and Tong (2000) are to long or to short individual stock market indexes. They assume that there is no restriction for investors in trading portfolios of indexes in individual markets worldwide. They construct a momentum-trading rule based on the stock market indexes of different countries.

The momentum portfolio, which is also called Weighted Relative Strength Strategy (WRSS), is used to evaluate the performance of stock index *i* with other stock indexes at time *t-1*. Define

$$w_{it}(k) = \frac{1}{N} [R_{it-1} - R_{mt-1}], \qquad (1)$$

where $w_{it}(k)$ refers to the fraction of the momentum portfolio to stock index *i* at time *t*, *k* refers to the number of weeks between *t* and *t-1*, the stock index return of country *i* at time *t-1* is defined as R_{it-1} and the mean stock index returns over *N* international equity markets at time *t-1* is defined as $R_{mt-1} = \frac{1}{N} \sum_{i=1}^{N} R_{it-1}$.

The return of stock index *i* at time *t* in terms of U.S. dollar is:

$$R_{it} \cong r_{it} + e_{it}, \qquad (2)$$

where r_{it} is the local currency return at time *t* and e_{it} is the percentage rate of change of local currency price relative to U.S. dollar at time *t*.

According to Chan, Hameed and Tong (2000), an investor in period *t* will long the winner countries[2] and short the loser countries[3] by using the signals, which generate at *t-1*. Therefore, by holding the long-and-short position in period *t*, the investor earns a profit of

$$\pi_t(k) = \sum_{i=1}^{N} w_{it}(k)\, R_{it}(k). \qquad (3)$$

To throw light on the possible sources of the profit, we decompose $\pi_t(k)$ into equity component, currency component and some interaction components; equation (3) can be rewritten as:

[2] "winner countries" are those countries whose returns are higher than the mean return of the portfolio.

[3] "loser countries" are those countries whose returns are lower than the mean return of the portfolio.

$$\pi_t(k) \cong \frac{1}{N}\left\{\sum_{i=1}^{N}[(r_{it-1}+e_{it-1})-(r_{mt-1}+e_{mt-1})][r_{it}+e_{it}]\right\}$$

$$= \frac{1}{N}\left\{\sum_{i=1}^{N}(r_{it-1}-r_{mt-1})r_{it}+\sum_{i=1}^{N}(r_{it-1}-r_{mt-1})e_{it}\right\}$$

$$+ \frac{1}{N}\left\{\sum_{i=1}^{N}(e_{it-1}-e_{mt-1})r_{it}+\sum_{i=1}^{N}(e_{it-1}-e_{mt-1})e_{it}\right\}, \quad (4)$$

where r_{mt-1} is the mean return of N countries' currencies at time $t-1$ and e_{mt-1} is the mean percentage rate of change of N countries' currency prices relative to U.S. dollar at time $t-1$.

By taking expectation of both sides of equation (4), four components[4] are generated.

$$E(\pi_t^1(k)) = \frac{1}{N}\sum_{i=1}^{N}E\{(r_{it-1}-r_{mt-1})r_{it}\}, \quad (5)$$

$$E(\pi_t^2(k)) = \frac{1}{N}\sum_{i=1}^{N}E\{(r_{it-1}-r_{mt-1})e_{it}\}, \quad (6)$$

$$E(\pi_t^3(k)) = \frac{1}{N}\sum_{i=1}^{N}E\{(e_{it-1}-e_{mt-1})r_{it}\}, \quad (7)$$

$$E(\pi_t^4(k)) = \frac{1}{N}\sum_{i=1}^{N}E\{(e_{it-1}-e_{mt-1})e_{it}\}. \quad (8)$$

[4] For detailed explanation of each component, please refer to Chan, Hameed and Tong (2000).

The first component in equation (5) refers to the profits contributed by the predictability of equity returns based on past equity performance, while the second component in equation (6) reflects profits contributed by the predictability of exchange rate returns based on past equity performance. The third component in equation (7) refers to the profits contributed by the predictability of equity returns based on past exchange rate performance. The fourth component in equation (8) reflects profits contributed by the predictability of exchange rate returns based on their past performance.

Since the sum of the momentum portfolios over N market indexes at time t is a zero-cost portfolio, i.e., $\sum_{i=1}^{N} w_{it}(k) = 0$, the aggregate investment at time t will be equal to:

$$l_t(k) = \sum_{i=1}^{N} |w_{it}(k)|, \tag{9}$$

and the difference in per-period returns between the winner and loser portfolio is equal to:

$$\frac{E(\pi_t(k))}{0.5 \times k \times l_t(k)}. \tag{10}$$

B. Relative Strength Indexes

1. Relative Strength Indexes

Relative Strength Index (RSI) is first introduced by Wilder (1978). To calculate the RSI, let

$$U_{ij} = \begin{cases} C_{ij} - C_{ij-1} & \text{if } C_{ij} > C_{ij-1} \\ 0 & \text{otherwise} \end{cases}, \qquad (11)$$

$$D_{ij} = \begin{cases} C_{ij-1} - C_{ij} & \text{if } C_{ij-1} > C_{ij} \\ 0 & \text{otherwise} \end{cases}, \qquad (12)$$

where C_{ij} is the closing price of stock index i at time j, U_{ij} and D_{ij} are the up-closes and down-closes of the stock prices[5] respectively.

Define

$$\mathrm{RS}_{it}(k) = \frac{\overline{U}_{it}(k)}{\overline{D}_{it}(k)}, \qquad (13)$$

[5] For any j, $\{j: t\text{-}p \le j \le t\}$.

where $\overline{\mathrm{U}}_{it}(k) = \frac{1}{k}\sum_{j=0}^{k-1} U_{it-j}$ and $\overline{\mathrm{D}}_{it}(k) = \frac{1}{k}\sum_{j=0}^{k-1} D_{it-j}$. The k-period RSI[6] of stock index i at time t is then defined as

$$\mathrm{RSI}_{\mathrm{it}}(k) = 100 - \frac{100}{1 + RS_{it}(k)}, \tag{14}$$

The above RSI ranges from 0 to 100. According to Murphy (1999), there are various ways to interpret RSI: tops and bottoms (70 and 30 lines), failure swings and centerline (50 line). For the tops and bottoms, if the RSI rises above 30 line, it is considered bullish for the underlying stock. Conversely, if the RSI falls below 70 line, it is a bearish signal. Some traders identify the long-term trend and then use extreme readings for entry points. The failure swings refers to the situation when the movements above 70 line or below 30 line on the RSI scale, it shows the strong indications of market reversals. Some traders view a RSI above 50 line as a bullish confirmation which represents the average gains overtaking average losses, while a RSI below 50 line as a bearish

[6] Wilder's (1978) RSI indicator does use the exponential moving average formula instead of the simple arithmetic average. For example, Wilder describes 1/14 of today's data + 13/14 of yesterday's index as a 14-day exponential moving average. If we refer to Exponential Moving Averages, we will find that the formula equates to a 27-day exponential moving average. However, the method of Wilder (1978) may smooth the RSI and generate less signals. By considering the Morris Modified RSI algorithm, it uses only the most recent trading days instead of averaging in past data. The Morris calculation typically generates more buy or sell signals when RSI crosses the threshold values. Therefore, in this paper, it will follow the Morris (1985) approach in calculating the RSI.

confirmation represents the average losses have taken the lead. In this paper, centerline trading rule is used to generate the signals of RSI. The rule is defined as:

$$\text{Buy:} \quad \mathrm{RSI_{it}(k)} \geq 50, \tag{15}$$

$$\text{Sell:} \quad \mathrm{RSI_{it}(k)} < 50. \tag{16}$$

For the RSI portfolio, the Weighted Relative Strength Strategy (WRSS) is slightly different from that of the momentum portfolio. Here

$$\mathrm{w_{it}(k)} = \frac{1}{\mathrm{N}} \left[\mathrm{R_{it}} - \mathrm{R_{mt}} \right], \tag{17}$$

where R_{it} is the return of stock index i at time t and R_{mt} is the mean stock index returns over N international equity markets at time t. $w_{it}(k)$ is the fraction of RSI portfolio to stock index i at time t.

Since an investor in period t will long the stock index i if $RSI_{it}(k) \geq 50$ and short it if $RSI_{it}(k) < 50$, the profit at time t is calculated by

$$\pi_t(k) = \sum_{i=1}^{N} \left| w_{it}(k) \right| \times R_{it} \times [1\{RSI_{it}(k) \geq 50\} - 1\{RSI_{it}(k) < 50\}], \tag{18}$$

where $1\{.\}$ is an indicator functions which equals one if the statement inside the bracket is correct, and equals zero otherwise.

As the sum of the RSI portfolios over N market indexes at time t is zero, i.e., $\sum_{i=1}^{N} w_{it}(k)=0$, the aggregate investment at time t is

$$l_t(k) = \sum_{i=1}^{N} |w_{it}(k)|, \tag{19}$$

The difference in per-period returns between the bullish and bearish portfolios is:

$$\frac{E(\pi_t(k))}{0.5 \times l_t(k)}. \tag{20}$$

2. Stochastic Relative Strength Index

StochRSI is first described by Chande and Kroll (1994). The StochRSI is defined as follows:

$$\text{StochRSI}_{it}(k) = \frac{RSI_{it}(k) - RSI_{iL}(k)}{RSI_{iH}(k) - RSI_{iL}(k)} \times 100, \tag{21}$$

where $RSI_t(k)$ is the RSI of country i at time t of period k, $RSI_H(k)$ is the highest value of RSI of country i over period k at time t, while $RSI_L(k)$ is the lowest value of RSI of country i over period k at time t. If RSI makes a new low, the StochRSI is equal to zero, while StochRSI equals one if RSI makes a new high.

In this paper, we use the same centerline trading signals in RSI when evaluating StochRSI, which is defined as:

$$\text{Buy:} \quad \text{StochRSI}_{it}(k) \geq 50, \tag{22}$$

$$\text{Sell:} \quad \text{StochRSI}_{it}(k) < 50. \tag{23}$$

The investor can earn a profit by using the similar equation in RSI, which is:

$$\pi_t^{'}(k) = \sum_{i=1}^{N} |w_{it}(k)| \times R_{it} \times [1\{StochRSI_{it}(k) \geq 50\} - 1\{StochRSI_{it}(k) < 50\}], \tag{24}$$

where w_{it} refers to the formula in equation (17), and we can also use the same zero cost strategies in RSI (equation (19)) to evaluate the weekly returns between the bullish and bearish portfolio (equation (20)) of StochRSI.

Chapter Three Data

We have already discussed the methodologies of calculating the profits of momentum strategies and relative strength index strategies. In this chapter, we will focus on the data analysis and the empirical findings of these two oscillators. The sample, which consists of the stock market indexes of twenty-one countries from 01/01/1986 to 30/06/2002, is taken from Datastream. To lay the groundwork, Table 1 shows the list of the twenty-one sample countries: seven of them are from the Asia-Pacific regions, i.e., Australia, Hong Kong, Japan, Malaysia, Singapore, Taiwan and Thailand and eleven of them are from Europe which are Austria, Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Spain, Switzerland and the United Kingdom. The remaining three are Canada, South Africa and the United States.

TABLE 1 HERE

Table 2 contains the summary statistics of weekly returns[7] for the twenty-one countries, whereas Table 3 contains the summary statistics of

[7] The weekly interval of holding periods begins on Thursday and ends on Thursday. If Thursday is a holiday, then the weekly interval begins on Wednesday and ends on Friday.

daily returns.

TABLE 2 HERE

TABLE 3 HERE

In terms of U.S. dollars, the mean average return of the portfolio is about 0.15% per week and 0.036% per day. The highest average weekly return is 0.23% generated by Taiwan, while the lowest is 0.03% by Japan. The highest average daily return is 0.05% generated by Switzerland, Spain and Taiwan, whereas the lowest is 0.01% by Japan. The weekly and daily standard deviations are about 2% for all countries.

Chapter Four Empirical Findings[8]

A. Momentum Strategies

In this chapter, we re-examine the findings of Chan et al. (2000). The momentum strategies that are discussed in Chapter Two will be implemented.

1. Profits from Basic Momentum Strategies

Table 4 presents the average weekly profits on these composite portfolio strategies from 1986 to mid-2002.

TABLE 4 HERE

The average total profits from momentum strategies, $\pi_t(k)$, are -0.0025 cent for one-week interval, 0.0426 cent for two-week interval, 0.0057 cent for four-week interval, -0.0032 cent for twelve-week interval and 0.0066 cent for twenty-six week interval. Most of the average total profits are not significantly different from zero except the profit from two-week momentum strategy. The results here are in stark contrast to those in Chan et al. (2000), who argue that momentum profits are significant.

[8] In order to reduce the influence from exchange rate and inflation fluctuations, all the profits are in terms of US dollar.

The first component of the momentum profits, $\pi_t^1(k)$, is the main contribution to the total profits. For instance, about 78% of the total profits[9] for the two-week holding period are contributed by $\pi_t^1(k)$. It indicates the importance of the predictability of the equity returns. However, $\pi_t^2(k)$ and $\pi_t^4(k)$ contribute only a relatively small part to the total profits. For example, less than 34%[10] of the total profits for the two-week holding period is contributed by the second and fourth components together. The third component has a negative contribution to the momentum profits in four-week interval, which implies there exists a negative relationship between the predictability of equity returns and the past exchange rate performance.

Weekly returns refer to the difference between the returns of the winner and loser portfolios. By using equation (10), we can calculate the weekly returns of the momentum portfolio for different holding periods. Table 4 reports that all of the average total profits and weekly returns are not

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[9] By using the formula: $\frac{\pi_t^1(k)}{\pi_t(k)}$

[10] By using the formula: $\frac{\pi_t^2(k)+\pi_t^4(k)}{\pi_t(k)}$

significantly different from zero except the one generated by the two-week momentum strategy.

2. Profits from Momentum Strategies with Transaction Costs Deducted

We consider transaction costs in this subsection. Transaction costs depend on the size of the trade and vary across countries, so it seems difficult to assess its magnitude. We adopt the practice of Sullivan, Timmermann and White (1997), who use the break-even transaction cost level of 0.27% per trade.

TABLE 5 HERE

Table 5 presents the comparison of momentum profits before and after the deduction of transaction costs. Note that, after considering the transaction fees, the net $\pi_t(k)$ becomes significantly negative. The net $\pi_t(k)$ from momentum strategies here is -0.0308 cent for one-week interval, 0.0143 cent for two-week interval, -0.0226 cent for four-week interval, -0.0315 cent for twelve-week interval and -0.0216 cent for twenty-six week interval. Recall that for average total profits without deducting the costs, only two-week holding period momentum profit is significantly different

from zero. However, when transaction costs are considered, the net average total profits for the one-week, four-week, twelve-week and twenty-six-week holding periods are all significantly negative.

The weekly returns from the momentum strategies after deducting the transaction fees are about -0.2849% for one-week interval, 0.0238% for two-week interval, -0.0672% for four-week interval, -0.0312% for twelve-week interval and -0.0104% for twenty-six-week interval. After considering the transaction costs, most of the net weekly returns are significantly negative at the 5% level except the weekly return to two-week holding period.

3. Profits from Buy-and-Hold Strategies

It has been argued that the buy-and-hold tactic is not the best strategy under the assumptions that there is no transaction cost, all information is known and the market is rational. In this part, we will construct the buy-and-hold[11] strategies by using the same data set in order to compare its profits with those from momentum strategies.

TABLE 6a HERE

TABLE 6b HERE

A buy-and-hold strategy to the portfolio trading refers to the difference between winner and loser countries. An investor allocates his investment by longing the winner countries' stock indexes and shorting the loser countries' stock indexes according to the first buy or sell signal of momentum strategies and holding these positions till the end of the sample period. Table 6a and 6b report the weekly returns of the sample countries under the implementation of buy-and-hold strategies. There are twelve winner countries and nine loser countries in the portfolio. Subtracting the total weekly returns to loser countries from the total

[11] Assume there is no restriction for investors in short-selling in international equity markets.

weekly returns to the winner countries, the net weekly returns from the buy-and-hold strategies are about 0.55% for one-week, two-week and four-week intervals while the weekly returns for twelve-week and twenty-six-week intervals are about 0.72% as reported in the last row of Table 6b. All the weekly returns from the buy-and-hold strategies are higher than the weekly returns of any holding periods for the momentum strategies from Table 4 and 5, both with and without deducting transaction costs. It indicates that the buy-and-hold strategies perform better than the momentum strategies.

4. Momentum Profits for Individual Countries After Risk Adjustment

Chan, Hameed and Tong (2000) examine the significance of momentum profits after adjusting for world beta risk, we replicate their analysis here. First, we normalize[12] the momentum profit of country *i* as below:

$$\pi_{it}^{*} = \frac{\pi_{it}(k)}{l_t(k)}. \tag{25}$$

Then we regress π_{it}^{*} on $R_{mt}^{'}$ (the excess return of the global market index constructed by Datastream[13]).

$$\pi_{it}^{*} = \alpha_i + \beta_i R_{mt}^{'} + \varepsilon_{it}, \tag{26}$$

where the constant term α_i refers to the abnormal profits of country *i* and the residual term is assumed to be independent, identically distributed within each equation.

TABLE 7 HERE

[12] The intuition of normalizing Momentum profits is to find out the per dollar Momentum profits, and it can help to avoid the bias in running regression.

[13] Bhojarj and Swaminathan (2001) state that there is no appreciable difference among the MSCI and the value-weighted stock market indexes, which are contructed by Datastream.

Table 7 reports the result of abnormal profits for those twenty-one countries after adjusting for the world beta risk. In contrast to Chan et al. (2000), we show that only few of the abnormal profits generate significantly positive returns, while most of the abnormal returns in all holding periods are not significantly different from zero. Therefore, most of the beta risk adjustment could explain the profits.

TABLE 8 HERE

Table 8 presents the abnormal profits for individual countries after adjusting the net momentum profits. About one-third of the abnormal profits from the table are significantly negative at the 5% or 10% levels, which are different from the findings in Table 7 that most of the abnormal returns are not significantly different from zero. Therefore, the beta risk adjustment could not explain the negative returns net of transaction fees by the significantly negative abnormal returns.

5. Relationship between Lead-Lag Effects and Momentum Profits

Lo and MacKinlay (1990) argue that a large part of the abnormal returns is attributable to a delayed stock price reaction to common market factors. Therefore, this subsection will test the relationship between the lead-lag effects and the momentum profits by the following return generating process:

$$\pi^{*}_{it} = \alpha_i + \beta_{1i} R^{'}_{mt} + \beta_{2i} R^{'}_{mt-n} + \varepsilon_{it}, \qquad (27)$$

where π^{*}_{it} is the normalized momentum profits of country i at time t, $R^{'}_{mt}$ is the excess return on the global market index at time t and $R^{'}_{mt-n}$ is the excess return on the global market index n months before time t. This paper will use one-month, three-month, six-month, nine-month and twelve-month lagged returns in equation (27), with the assumption that the return on the global market index is serially uncorrelated. According to Jegadeesh and Titman (1993), $\beta_{2i} > 0$ means the stock i partly reacts to the factor with a lag, and $\beta_{2i} < 0$ means stock i overreacts to contemporaneous factor but will be corrected in the subsequent period.

Table 9 to Table 13 present the sensitivities to the lagged factor realization of all the sample countries after taking transaction costs into account.

TABLE 9 HERE

TABLE 10 HERE

TABLE 11 HERE

TABLE 12 HERE

TABLE 13 HERE

It is found that few β_{2i} are negatively significant, but most of the β_{2i} are not significantly different from zero. Therefore, it implies that the negative momentum profits cannot be attributed to lead-lag effects, which result from the delayed stock price reactions to common market factor, only few negative profits can be explained by its overreaction to the contemporaneous factor.

B. Relative Stregth Indexes

This section examines the profitability of the Relative Strength Indexes that discussed in Chapter Two.

1. Profits from Relative Strength Index (RSI)

Table 14 gives the results for the five periods RSI strategies from 1986 to mid-2002, by using the centerline trading method.

TABLE 14 HERE

The average total profits from RSI strategies are 0.0980 cent for 7-day RSI, 0.0951 cent for 9-day RSI, 0.091 cent for 14-day RSI, 0.0869 cent for 21-day RSI and 0.0838 cent for 28-day RSI. All the results are significant. The 7-day RSI strategy gives the highest average total profit among all the RSI strategies. Overall, the results are very impressive.

The daily returns represent the difference between the returns of the bullish and bearish portfolios. We can calculate the daily returns of the RSI strategies by using equation (20). Table 14 reports that all the RSI strategies generate statistically significant daily returns of about 2%.

By taking 0.27% transaction cost per a complete trade into account, it is found that none of the net average total profit (*Net* $\pi_t(k)$) from RSI strategies loss its significance. All the daily returns are still statistically significant.

2. Profits from Buy-and-Hold Strategies

Fama and Blume (1966) argue that, some of the filters they examine give returns above buy-and-hold; the inclusion of transaction costs eliminates the profits. In this subsection, we construct the buy-and-hold strategies, which are similar to those of the buy-and-hold strategies in the last section, and compare the profitability of buy-and-hold strategies with those of RSI strategies.

TABLE 15a HERE

TABLE 15b HERE

A buy-and-hold strategy to the portfolio trading in this subsection refers to the difference between bullish and bearish countries. An investor allocates his investments by longing the bullish countries' stock indexes and shorting the bearish countries' stock indexes which follows the first buy and sell signal of RSI strategies and holding these positions till the end of the sample period. The daily returns of the sample countries under the implementation of buy-and-hold strategies are reported in Table 15a and 15b. Because of the difference in the first signals of various RSI strategies, there arise different bullish and bearish countries. After subtracting the

total daily returns to loser countries from the total daily returns to the bullish countries, the net daily returns from the buy-and-hold strategies are about 0.26% for 7-day RSI, -0.15% for 9-day RSI, -0.06% for 14-day RSI, 0.04% for 21-day RSI and 0.33% for 28-day RSI as reported in the last row of Table 15b. When compared with the daily returns from the RSI strategies, it is found that all the daily returns from RSI strategies in Table 14, both with and without deducting transaction costs, are better than the buy-and-hold strategies.

3. Profits from Relative Strength Index (RSI) for Individual Countries After Risk Adjustment

In this subsection, we will use the same method as Chan, Hameed and Tong (2000) to test the significance of profits from RSI strategies after adjusting for world beta risk. The normalized profit of country *i* is equal to:

$$\pi^{*}_{it} = \frac{\pi_{it}(k)}{l_t(k)}. \qquad (28)$$

After that, we regress the normalized RSI's profit of country *i* (π^{*}_{it}) on R'_{mt}, which is the excess return of global market index constructed by Datastream, by equation (26).

TABLE 16 HERE

Table 16 shows the abnormal profits for the sample countries after adjusting for the world beta risk. It is found that all the abnormal profits generate significantly positive returns, and they are significant at the 1% level. Thus, the positive significant profits from RSI strategies cannot be explained by the beta risk adjustment.

TABLE 17 HERE

Table 17 reports the abnormal profits for those twenty-one countries after risk adjusted net profits from relative strength index. It shows that all the profits from the table are significantly positive at the 1% level, which is the same as the findings in Table 16 that all the abnormal profits are significantly positive. Therefore, the beta risk adjustment could not explain the positive returns with or without the deduction of transaction costs by the significantly positive abnormal returns.

4. Relationship between Lead-Lag Effects and Profits from Relative Strength Index (RSI)

This subsection will test the relationship between the lead-lag effects and the profits from the relative strength indexes by equation (27). Again, we use one-month, three-month, six-month, nine-month and twelve-month lagged excess returns as the regressor.

TABLE 18 HERE

TABLE 19 HERE

TABLE 20 HERE

TABLE 21 HERE

TABLE 22 HERE

Table 18 to 22 reports the sensitivities to the lagged factor realization of those twenty-one countries. It is found that only some of the β_{2i} from the one-month lagged factor generate significantly positive returns, while most of them are not significantly different from zero.

TABLE 23 HERE

TABLE 24 HERE

TABLE 25 HERE

TABLE 26 HERE

TABLE 27 HERE

Table 23 to Table 27 gives the result for the sensitivities to the lagged factor realization of all the sample countries after taking transaction costs into consideration. Similar to the findings in Table 18 to Table 22, some of the β_{2i} from the one-month lagged factor generate significantly positive returns, which are significantly positive at the 5% and 10% levels, while most of the sensitivities to the lagged factor are not significantly different from zero. Surprisingly, some of the countries' indexes are sensitive to specific lagged factors, for instance, Bangkok S.E.T. Index and FAZ General Index react to common market factors with a one-month lag, Austria's DS Market Index, Taiwan SE Weighted Index and Dow Jones Industrial Index overreact to contemporaneous factor but will be corrected in one-month, three-month and nine-month periods respectively.

Thus, it implies that most of the positive profits from RSI strategies cannot be attributed to lead-lag effects resulted from the delayed stock price reactions to common market factor, only few countries' indexes react to specific lagged factor.

5. A Comparison of Momentum Strategies with Relative Strength Indexes

As we cannot use the weekly returns to momentum strategies to compare with the daily returns to RSI strategies[14], we will evaluate the profitability of both oscillators by their total average profits[15].

TABLE 28 HERE

Table 28 presents the average total profits. The average of total daily momentum profits is -0.0001 cent for 1-week interval, 0.0032 cent for 2-week interval, 0.0008 cent for 4-week interval, 0.0016 cent for 12-week interval and 0.0002 cent for 26-week interval. Most of the present results are not significantly different from zero except the profits from 2-week and 12-week intervals, which are significantly at the 5% and 10% levels respectively. Note that for the average total profits from RSI, all are significantly positive. Therefore, without considering the transaction costs, RSI strategies perform better than momentum strategies.

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[14] In order to have a complete comparison among our paper and Chan et al. (2000)'s paper, we use the weekly data as Chan in finding the profitability of Momentum Strategies. For RSI, it is more reliable by using daily data in calculating its profits then weekly data, thus we re-calculate the Momentum profits by using the daily data for getting a complete comparison of these two trading rules.

[15] We use daily data rather than weekly data to analysis the profitability of the trading rules.

The average of total daily momentum profits after taking transaction costs into account is about -0.0272 cent for 1-week interval, -0.0239 cent for 2-week interval, -0.0264 cent for 4-week interval, -0.0255 cent for 12-week interval and -0.0266 cent for 26-week interval. After considering the transaction costs, all the total average momentum profits are significantly negative at the 5% level. For RSI, all the profits are still significantly positive. Therefore, with or without taking transaction costs into account, RSI strategies perform better than the momentum strategies.

6. A Comparison of Relative Strength Indexes with Stochastic Relative Strength Indexes Oscillator

The Stochastic Relative Strength Indexes (StochRSI) combines the two famous trading rules, which are RSI and the stochastic oscillator. StochRSI is first described by Chande and Kroll (1994). The sensitivity of the StochRSI overcomes the shortcomings of using a fixed number of days in its calculation and the tendency of the built-in RSI smoothing to mask short-lived price extremes while showing failure swings in RSI. Besides, we can also combine all the different elements, i.e., failure swings, divergences, of RSI analysis into the StochRSI indicator.

TABLE 29 HERE

Table 29 reports the profits from five periods' Stochastic Relative Strength Indexes (StochRSI) by using the centerline trading method as defined in equation (22) and (23). In comparison with the results of RSI in Table 14, it is found that there is no major difference between its (net) profits and (net) daily profits. Therefore, we can conclude that the disadvantages of RSI are not so severe to influence the profitability of RSI.

Chapter Five Conclusion

This paper re-examines whether Chan, Hameed and Tong (2000)'s findings on momentum strategies have predictive ability on similar portfolio when transaction costs and longer sample period are taken into account. Our results support the weak form efficiency of international equity markets. The four holding periods' momentum profits will become significantly negative once a trivial transaction cost is incorporated. Various lead-lag effects cannot explain these negative profits after several tests. When we compare the weekly returns between the buy-and-hold strategies and the momentum strategies, both with and without transaction costs, the buy-and-hold strategies always dominate. Our results contradict the findings of Chan et al. (2000), which suggest that the buy-and-hold strategies are more profitable than the momentum strategies in a long time horizon. The longer and more recent sample period that we use throughout this paper can explain the diversion of findings between our paper and Chan et al. (2000)'s. According to Efficient Market Hypothesis, investors cannot gain extra returns if they do not bare extra risk. Most of the abnormal returns from the momentum strategies without transaction costs

presented in this paper further support this theory since it does not provide any abnormal returns after adjusting for the world beta risk.

We also examine the profitability of RSI strategies based on the past returns of country indexes in the international equity markets. We show that, with or without taking transaction costs into account, RSI strategies still generate significantly positive profits and perform much better than the momentum strategies and buy-and-hold strategies. The Efficient Market Hypothesis cannot be supported by the RSI strategies, since the profits from the RSI strategies are supported by the abnormal profits after adjusting for the world beta risk, and most of the abnormal profits cannot be explained by various lead-lag effects after tested by the simple return-generating model. Besides, the deficiencies of RSI by using a fixed number of days in its calculation and the tendency of the built-in RSI smoothing to mask short-lived price extremes are not so severe to affect the profitability of RSI after the calculation of Stochastic RSI.

Table 1: Sample countries, stock market indexes and the local currencies of the sample countries

Country	Index Name	Currency
Australia	Australia - DS Market Index	Australian Dollar
Austria	Austria - DS Market Index	Austria Schilling
Belgium	Brussels All Share Index	Belgium Franc
Canada	Canada - DS Market Index	Canadian Dollar
Denmark	Copenhagen SE - DS General Index	Danish Kroner
France	France - DS Market Index	French Franc
Germany	FAZ General Index	Deutsche Mark
Hong Kong	Hang Seng Index	Hong Kong Dollar
Italy	Milan Comit General Index	Italian Lire
Japan	Nikkei 225 Stock Average Index	Japanese Yen
Malaysia	Kuala Lumpur Composite Index	Malaysian Ringgit
Netherlands	CBS Allshare General Index	Dutch Guilder
Norway	Norway - DS Market Index	Norwegian Kroner
Singapore	Singapore Strait T. DS Index	Singapore Dollar
South Africa	South Africa - DS Market Index	S. Africa Rand
Spain	Madrid SE General Index	Spanish Peseta
Switzerland	Switzerland - DS Market Index	Swiss Franc
Taiwan	Taiwan SE Weighted Index	Taiwan Dollar
Thailand	Bangkok S.E.T. Index	Thai and Baht
U.K.	FTSE 30 Ordinary Share Index	Sterling Pound
U.S.	Dow Jones Industrial Index	U.S. Dollar

Table 2: Summary Statistics of Weekly Return for twenty-one Sample Countries

Countries	Mean	Standard Deviation
Australia	0.0015	0.0298
Austria	0.0011	0.0288
Belgium	0.0017	0.0237
Canada	0.0014	0.0225
Denmark	0.0016	0.0232
France	0.0019	0.0269
Germany	0.0010	0.0288
HK	0.0021	0.0405
Italy	0.0010	0.0333
Japan	0.0003	0.0342
Malaysia	0.0008	0.0466
Netherlands	0.0018	0.0230
Norway	0.0018	0.0318
Singapore	0.0015	0.0342
South Africa	0.0013	0.0365
Spain	0.0021	0.0324
Swiss	0.0022	0.0237
Taiwan	0.0023	0.0537
Thailand	0.0007	0.0487
U.K.	0.0008	0.0256
U.S.	0.0020	0.0225

Table 3: Summary Statistics of Daily Return for twenty-one Sample Countries

Countries	Mean	Standard Deviation
Australia	0.0004	0.0130
Austria	0.0003	0.0113
Belgium	0.0004	0.0100
Canada	0.0003	0.0093
Denmark	0.0003	0.0101
France	0.0005	0.0119
Germany	0.0003	0.0138
HK	0.0005	0.0183
Italy	0.0003	0.0142
Japan	0.0001	0.0160
Malaysia	0.0002	0.0197
Netherlands	0.0004	0.0110
Norway	0.0004	0.0143
Singapore	0.0003	0.0151
South Africa	0.0003	0.0149
Spain	0.0005	0.0130
Swiss	0.0005	0.0107
Taiwan	0.0005	0.0215
Thailand	0.0003	0.0199
U.K.	0.0002	0.0111
U.S.	0.0005	0.0111

Table 4: Average Profits from the Momentum Strategies Implemented on International Stock Market Indexes

	1-week	2-week	4-week	12-week	26-week
π_t^1 (k)	0.0050	0.0334*	0.0102	0.0044	0.0094
t-test	(0.5601)	(3.4667)	(1.1689)	(0.5947)	(1.3102)
π_t^2 (k)	-0.0004	0.0088*	0.0017	-0.0035	0.0005
t-test	(-0.1236)	(2.8695)	(0.5916)	(-1.2457)	(0.1742)
π_t^3 (k)	-0.0040	-0.0052	-0.0087*	-0.0011	-0.0015
t-test	(-1.3871)	(-1.5215)	(-2.4107)	(-0.3510)	(-0.5588)
π_t^4 (k)	-0.0031	0.0055*	0.0026	-0.0031	-0.0018
t-test	(-1.1086)	(2.2388)	(0.1173)	(-1.4520)	(-1.0445)
π_t (k)	-0.0025	0.0426*	0.0057	-0.0032	0.0066
t-test	(-0.2276)	(3.6845)	(0.4615)	(-0.3282)	(0.7527)
Aggregate Investment	18.3201	18.3266	18.3349	18.3762	18.4357
Weekly Return (in 100%)	0.0634	0.1979*	0.0198	-0.0023	0.0029
t-test	(0.6919)	(4.2403)	(0.8872)	(-0.3208)	(0.9111)

* significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

The market indexes in the Momentum Strategies are denominated into U.S. dollars. The aggregate investment and all average profits π_t^1, π_t^2, π_t^3, π_t^4 and π_t are multiplied by 1000, while weekly returns are in 100%.

Table 5: Net Average Profits from the Momentum Strategies Implemented on Stock Market Indexes of twenty-one Countries by using the data from 01/01/1986 to 30/06/2002

	1-week	2-week	4-week	12-week	26-week
Average Cost	0.0283	0.0283	0.0283	0.0283	0.0283
Net π_t (k)	-0.0308*	0.0143	-0.0226**	-0.0315*	-0.0216*
t-test	(-2.7855)	(1.2322)	(-1.8256)	(-3.1866)	(-2.4527)
Net Weekly π_t (k) (in 100%)	-0.2849*	0.0238	-0.0672*	-0.0312*	-0.0104*
t-test	(-3.1055)	(0.5077)	(-3.0066)	(-4.4293)	(-3.2949)

*significant at the 5% level for a two-tailed test

** significant at the 10% level for a two-tailed test

Average cost is equal to average of the number of transactions × 0.27%.

Net average total profit is equal to the average total profit minus 0.27% transaction costs per a complete trade.

Table 6a: Weekly Returns to Buy-and-Hold Strategies for Winner Countries over the Full Sample Period (in 100%)

Winner Countries	1-Week	2-Week	4-Week	12-Week	26-Week
Australia	0.14	0.14	0.14	0.13	0.15
Austria	0.11	0.11	0.12	0.13	0.11
Germany	0.09	0.10	0.10	0.09	0.10
Hong Kong	0.21	0.21	0.21	0.22	0.22
Malaysia	0.09	0.09	0.09	0.11	0.10
Norway	0.18	0.19	0.18	0.19	0.20
Singapore	0.15	0.15	0.14	0.14	0.12
South Africa	0.12	0.12	0.11	0.10	0.11
Spain	0.20	0.20	0.20	0.16	0.14
Switzerland	0.21	0.22	0.22	0.21	0.21
Taiwan	0.23	0.23	0.22	0.22	0.21
Thailand	0.07	0.07	0.07	0.07	0.07
Total Weekly Returns to Buy Countries	**1.80**	**1.83**	**1.80**	**1.77**	**1.74**

Table 6b: Weekly Returns to Buy-and-Hold Strategies for Loser Countries over the Full Sample Period (in 100%)

Loser Countries	1-Week	2-Week	4-Week	12-Week	26-Week
Belgium	0.17	0.17	0.16	0.14	0.13
Canada	0.14	0.14	0.14	0.13	0.13
Denmark	0.17	0.17	0.16	0.16	0.16
France	0.19	0.19	0.19	0.16	0.16
Italy	0.09	0.09	0.09	0.04	0.04
Japan	0.03	0.03	0.02	0.00	-0.03
Netherlands	0.18	0.19	0.18	0.18	0.17
United Kingdom	0.08	0.09	0.08	0.05	0.06
United States	0.21	0.21	0.21	0.20	0.19
Total Weekly Returns to Loser Countries	**1.26**	**1.28**	**1.23**	**1.06**	**1.01**
Net Returns to Buy-and-Hold Strategies	**0.54**	**0.55**	**0.57**	**0.71**	**0.73**

Table 7: Abnormal Profits for Individual Countries After Risk Adjusted Momentum Profits by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	-0.0132	-0.0042	0.1012	0.0504	0.0289
Austria	0.0661	0.0031	-0.0330	0.0832	-0.0061
Belgium	-0.0150	0.0246	0.0534	0.0169	-0.0238
Canada	-0.0204	0.0143	0.0247	0.0157	0.0386
Denmark	-0.0166	0.0312	-0.0044	0.0114	0.0028
France	0.0945*	-0.0168	0.0604	-0.0858**	0.0659
Germany	-0.0205	-0.0040	0.0012	-0.0599	0.0094
Hong Kong	-0.0336	0.1583	-0.1289	-0.0441	0.0473
Japan	-0.0113	0.2376*	-0.0964	0.0640	0.0105
Malaysia	-0.0104	0.1324	0.1005	0.0921	-0.1589
Netherlands	-0.0373	0.0435	0.0609*	0.0221	0.0271
Norway	0.0091	0.0389	0.0210	0.0588	0.0159
Singapore	-0.0487	-0.0093	0.0164	0.0056	0.0365
South Africa	-0.1147	0.1581**	-0.0796	-0.1851**	-0.0525
Spain	0.0223	0.0092	0.0715	-0.0735	0.0321
Switzerland	-0.0210	0.0343	0.0482	-0.0234	0.0042
Taiwan	0.3348	0.7212*	0.0448	0.2030	0.1488
Thailand	0.1805	0.2372	0.1285	-0.0833	-0.0052
United Kingdom	0.1490	0.0706**	0.0070	-0.0613	0.0274
United States	-0.0361	-0.0169	0.0065	-0.0208	-0.0148

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 8: Abnormal Profits for Individual Countries After Risk Adjusted Net Momentum Profits by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	-0.0980	-0.0892**	0.0161	-0.0344	-0.0451
Austria	-0.0165	-0.0797	-0.1158	-0.1660*	-0.0885
Belgium	-0.0979*	-0.0581	-0.0294	-0.0655**	-0.1061*
Canada	-0.1032*	-0.0684	-0.0576	-0.0670*	-0.0434
Denmark	-0.1020*	-0.0542	-0.0897*	-0.0736*	-0.0810*
France	-0.0111	-0.0999*	-0.0231	-0.1689*	-0.0170
Germany	-0.1070**	-0.0905**	-0.0851**	-0.1460*	-0.0759
Hong Kong	-0.1134	0.0785	-0.2084**	-0.1235	-0.0314
Italy	-0.0837	0.0441	-0.0717	-0.0274	0.0557
Japan	-0.0920	0.1569**	-0.1774**	-0.0165	-0.0702
Malaysia	-0.0941	0.0487	0.0168	0.0085	-0.2420
Netherlands	-0.1234*	-0.0424	-0.0252	-0.0637*	-0.0581**
Norway	-0.0746	-0.0444	-0.0626	-0.0243	-0.0677
Singapore	-0.1361**	-0.0963	-0.0706	-0.0819	-0.0504
South Africa	-0.1979*	0.0752	-0.1624**	-0.2681*	-0.1353**
Spain	-0.0572	-0.0701	-0.0079	-0.1520*	-0.0452
Switzerland	-0.0982*	-0.0428	-0.0288	-0.1006*	-0.0721*
Taiwan	0.2525	0.6391*	-0.0037	0.1218	0.0681
Thailand	0.1007	0.1576	0.0486	-0.1627	-0.0848
United Kingdom	-0.0713**	-0.0157	-0.0796**	-0.1479*	-0.0591
United States	-0.1249*	-0.1059*	-0.0824*	-0.1091*	-0.1030*

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 9: Sensitivities to the 1-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	0.0003	0.0019	-0.0003	-0.0012	0.0005
Austria	0.0012	0.0018	0.0009	0.0032	0.0006
Belgium	-0.0032	-0.0006	0.0008	-0.0004	0.0018
Canada	0.0045*	0.0001	-0.0036**	-0.0011	-0.0024
Denmark	0.0027	-0.0022	-0.0044*	0.0012	-0.0011
France	0.0003	-0.0027	0.0008	0.0012	0.0027
Germany	-0.0015	0.0017	-0.0015	0.0023	0.0018
Hong Kong	-0.0029	-0.0022	0.0011	-0.0060	0.0051
Italy	0.0003	0.0051	0.0029	0.0019	0.0031
Japan	-0.0019	0.0059	0.0057	-0.0041	0.0048
Malaysia	0.0040	-0.0038	-0.0042	0.0042	-0.0013
Netherlands	0.0015	-0.0002	-0.0002	-0.0006	0.0004
Norway	0.0010	-0.0067**	-0.0046	0.0013	0.0014
Singapore	0.0007	0.0004	-0.0017	0.0075*	0.0031
South Africa	0.0023	0.0021	0.0041	0.0051	0.0010
Spain	-0.0067**	0.0006	0.0002	0.0013	0.0017
Switzerland	-0.0006	-0.0024	-0.0003	0.0011	-0.0004
Taiwan	0.0274*	0.0377*	0.0166	-0.0267*	-0.0190
Thailand	0.0114	0.0007	-0.0011	-0.0030	0.0027
United Kingdom	0.0017	0.0001	-0.0003	-0.0003	0.0004
United States	0.0021	0.0022	-0.0012	0.0008	-0.0025

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 10: Sensitivities to the 3-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	0.0071*	-0.0030	0.0002	0.0013	-0.0032
Austria	-0.0010	0.0007	-0.0024	0.0034	0.0062**
Belgium	-0.0006	0.0016	0.0023	-0.0004	-0.0006
Canada	0.0005	0.0008	-0.0035**	-0.0026	0.0020
Denmark	-0.0003	-0.0012	-0.0000	0.0025	-0.0002
France	-0.0058*	-0.0006	0.001	0.0022	-0.0015
Germany	-0.0049**	-0.0044**	-0.0013	0.0051*	0.0004
Hong Kong	-0.0071	0.0085	-0.0094**	0.0017	0.0070
Italy	0.0003	-0.0041	-0.0022	0.0024	-0.0017
Japan	0.0031	0.0053	0.0026	0.0030	0.0001
Malaysia	0.0113	0.0010	-0.0011	-0.0008	0.0046
Netherlands	-0.0030*	-0.0013	0.0002	0.0008	-0.0011
Norway	-0.0054	-0.0005	-0.0023	0.0009	-0.0021
Singapore	0.0041	0.0006	0.0028	0.0006	0.0029
South Africa	-0.0100*	-0.0082**	0.0015	-0.0131*	0.0050
Spain	-0.0066**	0.0083*	0.0001	0.0027	0.0015
Switzerland	-0.0003	-0.0002	-0.0002	0.0016	0.0013
Taiwan	-0.0442*	-0.0313*	-0.0062	-0.0014	0.0128
Thailand	0.0070	0.0119	-0.0043	-0.0042	0.0131
United Kingdom	0.0004	0.0009	0.0012	0.0010	-0.0011
United States	0.0010	-0.0013	0.0034**	-0.0013	-0.0020

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 11: Sensitivities to the 6-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	0.0041	0.0001	0.0034	-0.0053**	-0.0014
Austria	-0.0043	-0.0035	0.0060	0.0005	-0.0008
Belgium	-0.0032	0.0003	0.0021	0.0010	-0.0021
Canada	0.0014	-0.0005	0.0011	-0.0002	0.0000
Denmark	-0.0042*	-0.0019	-0.0029	-0.0020	-0.0006
France	-0.0004	0.0024	0.0019	-0.0006	0.0044*
Germany	0.0067*	0.0016	-0.0038	0.0032	-0.0019
Hong Kong	0.0030	0.0006	-0.0047	-0.0003	-0.0006
Italy	-0.0001	0.0042	0.0030	-0.0023	-0.0019
Japan	-0.0002	-0.0035	0.0003	0.0050	0.0022
Malaysia	0.0069	0.0032	0.0108	0.0091	0.0016
Netherlands	0.0025	0.0018	0.0008	-0.0007	-0.0033*
Norway	0.0005	-0.0050	-0.0045	0.0040	0.0017
Singapore	0.0043	0.0011	-0.0016	0.0005	0.0045
South Africa	0.0038	-0.0010	0.0009	-0.0057	-0.0022
Spain	0.0007	0.0005	-0.0043	-0.0061**	0.0050
Switzerland	0.0009	0.0007	0.0020	-0.0001	-0.0028**
Taiwan	-0.0040	0.0131	0.0017	-0.0083	0.0078
Thailand	-0.0009	-0.0051	0.0142**	0.0065	0.0023
United Kingdom	-0.0005	0.0019	-0.0028	-0.0028	-0.0025
United States	0.0004	-0.0042**	-0.0003	0.0011	-0.0003

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 12: Sensitivities to the 9-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	-0.0017	-0.0027	0.0025	0.0004	0.0056**
Austria	0.0007	-0.0043	-0.0006	-0.0007	0.0034
Belgium	-0.0007	0.0010	0.0004	0.0002	-0.0016
Canada	-0.0023	0.0042*	0.0006	-0.0044*	0.0028
Denmark	-0.0021	-0.0014	-0.0024	-0.0003	-0.0015
France	0.0011	-0.0028	-0.0015	-0.0001	-0.0034
Germany	0.0018	-0.0043**	0.0043**	-0.0019	-0.0008
Hong Kong	-0.0004	-0.0030	-0.0053	-0.0045	0.0048
Italy	0.0029	-0.0057	-0.0022	0.0011	-0.0004
Japan	-0.0028	0.0020	0.0052	0.0023	-0.0076
Malaysia	-0.0080	-0.0008	-0.0066	-0.0070	-0.0083
Netherlands	0.0009	-0.0034*	-0.0020	0.0022	0.0013
Norway	0.0026	-0.0064**	0.0013	-0.0042	-0.0013
Singapore	0.0013	-0.0040	-0.0048	-0.0025	-0.0049
South Africa	-0.0057	-0.0047	-0.0020	0.0090*	-0.0005
Spain	0.0004	-0.0028	-0.0029	-0.0031	-0.0029
Switzerland	-0.0023	0.0020	-0.0016	0.0010	-0.0029*
Taiwan	-0.0039	-0.0178	-0.0136	-0.0096	-0.0193
Thailand	-0.0034	0.0131	0.0087	0.0138	-0.0008
United Kingdom	0.0004	-0.0020	-0.0017	0.0042*	-0.0027
United States	0.0043*	0.0035	-0.0001	-0.0016	0.0021

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 13: Sensitivities to the 12-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	1-week	2-week	4-week	12-week	26-week
Australia	0.0040	0.0042	0.0034	-0.0007	0.0014
Austria	0.0022	-0.0022	0.0023	-0.0001	-0.0026
Belgium	-0.0019	0.0009	0.0028	0.0017	-0.0003
Canada	0.0008	-0.0013	0.0006	0.0004	-0.0036
Denmark	-0.0000	0.0027	-0.0010	-0.0006	-0.0026
France	-0.0019	-0.0018	-0.0007	-0.0022	-0.0024
Germany	-0.0009	-0.0009	-0.0007	-0.0005	-0.0034
Hong Kong	-0.0040	0.0049	-0.0060	-0.0021	0.0080
Italy	-0.0015	-0.0005	0.0011	-0.0000	0.0029
Japan	0.0031	-0.0052	0.0011	0.0004	0.0005
Malaysia	-0.0011	0.0033	-0.0005	-0.0038	0.0073
Netherlands	-0.0001	-0.0036*	-0.0002	0.0006	-0.0043*
Norway	0.0013	0.0041	-0.0079*	-0.0030	-0.0049
Singapore	0.0055	-0.0004	-0.0008	-0.0071**	-0.0017
South Africa	-0.0102*	-0.0028	-0.0078	0.0076	-0.0035
Spain	-0.0002	-0.0030	-0.0000	-0.0006	0.0023
Switzerland	0.0010	-0.0025	0.0009	-0.0013	-0.0026**
Taiwan	-0.0115	-0.0082	0.0178	0.0195	-0.0010
Thailand	-0.0004	0.0088	0.0098	-0.0099	0.0028
United Kingdom	-0.0008	-0.0015	0.0029	0.0008	-0.0045*
United States	-0.0009	0.0003	0.0005	-0.0030	-0.0024

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 14: Average Profits from the Relative Strength Index Implemented on International Stock Market Indexes

	7-day	9-day	14-day	21-day	28-day
π_t (k)	0.0980*	0.0951*	0.0910*	0.0869*	0.0838*
t-test	(24.3660)	(23.8501)	(22.8806)	(21.6564)	(20.7585)
Daily π_t (k) (in 100%)	2.0525*	2.0040*	1.9217*	1.8408*	1.7862*
t-test	(63.8476)	(62.0366)	(58.9279)	(55.3569)	(52.9378)
Net π_t (k)	0.0893*	0.0875*	0.0852*	0.0822*	0.0799*
t-test	(22.2024)	(21.9636)	(21.4149)	(20.5041)	(19.7955)
Net Daily π_t (k) (in 100%)	1.8075*	1.7915*	1.7556*	1.7083*	1.6740*
t-test	(55.3910)	(54.8164)	(53.4021)	(51.0006)	(49.3777)
Average Cost	0.0087	0.0075	0.0059	0.0047	0.0040
Aggregate Investment	8.0190	8.0190	8.0175	8.0129	8.0190

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Average cost is equal to average of the number of transactions × 0.27%.

Net average total profit is equal to the average total profit minus 0.27% transaction costs per a complete trade.

The market indexes in the Relative Strength Indexes are denominated into U.S. dollar. The aggregate investment and all average profits are multiplied by 1000, while daily returns are in 100%.

Table 15a: Daily Returns to Buy-and-Hold Strategies for Winner Countries over the Full Sample Period (in 100%)

	7-day	9-day	14-day	21-day	28-day
Australia	0.03	0.03	0.03	0.03	0.03
Austria	0.02	0.02	0.02	0.02	-
Belgium	-	-	-	-	0.03
France	0.04	-	-	0.04	0.04
Germany	0.02	0.02	0.02	0.02	0.02
Hong Kong	0.04	0.04	0.04	-	0.04
Italy	0.02	0.02	0.02	0.02	0.02
Japan	-	-	-	0.01	0.01
Netherlands	0.04	-	-	-	0.04
Norway	0.04	-	-	-	-
Singapore	0.02	0.03	0.03	0.03	0.02
South Africa	0.03	0.02	0.02	0.02	0.03
Spain	0.04	0.04	0.04	0.04	0.04
Switzerland	0.04	-	0.04	0.04	0.04
Taiwan	0.05	0.05	0.05	0.05	0.04
Thailand	0.01	-	-	0.01	0.01
United Kingdom	-	-	-	-	0.02
United States	-	-	-	-	0.04
Total Daily Returns to Winner Countries	**0.44**	**0.27**	**0.32**	**0.33**	**0.48**

Table 15b: Daily Returns to Buy-and-Hold Strategies for Loser Countries over the Full Sample Period (in 100%)

	7-day	9-day	14-day	21-day	28-day
Austria	-	-	-	-	0.02
Belgium	0.04	0.04	0.04	0.03	-
Canada	0.03	0.03	0.03	0.03	0.03
Denmark	0.03	0.03	0.03	0.03	0.03
France	-	0.04	0.04	-	-
Hong Kong	-	-	-	0.04	-
Japan	0.01	0.08	0.08	-	-
Malaysia	0.02	0.02	0.02	0.02	0.02
Netherlands	-	0.04	0.04	0.04	-
Norway	-	0.04	0.04	0.04	0.04
Switzerland	-	0.04	-	-	-
Thailand	-	0.01	0.01	-	-
United Kingdom	0.02	0.02	0.02	0.02	-
United States	0.04	0.04	0.04	0.04	-
Total Daily Returns to Winner Countries	**0.18**	**0.43**	**0.38**	**0.29**	**0.14**
Net Daily Returns to Buy-and-Hold Strategies	**0.26**	**-0.15**	**-0.06**	**0.04**	**0.33**

Table 16: Abnormal Profits for Individual Countries After Risk Adjusted Profits to Relative Strength Indexes by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.4306*	0.4124*	0.3861*	0.3634*	0.3728*
Austria	0.3088*	0.2943*	0.2917*	0.2665*	0.2577*
Belgium	0.2092*	0.2019*	0.1945*	0.1759*	0.1853*
Canada	0.2073*	0.2015*	0.1935*	0.1651*	0.1772*
Denmark	0.2339*	0.2248*	0.2173*	0.1996*	0.1991*
France	0.2904*	0.2794*	0.2714*	0.2521*	0.2563*
Germany	0.3870*	0.3799*	0.3696*	0.3367*	0.3381*
Hong Kong	0.7258*	0.6871*	0.6950*	0.6048*	0.6607*
Italy	0.4302*	0.5038*	0.4757*	0.4580*	0.4413*
Japan	0.7120*	0.6733*	0.6358*	0.5505*	0.5614*
Malaysia	0.8477*	0.7896*	0.7437*	0.6764*	0.6414*
Netherlands	0.1866*	0.1809*	0.1790*	0.1602*	0.1758*
Norway	0.4790*	0.4588*	0.4380*	0.3912*	0.4204*
Singapore	0.4788*	0.4589*	0.4437*	0.4075*	0.4278*
South Africa	0.5862*	0.5568*	0.5568*	0.4876*	0.4801*
Spain	0.3947*	0.3710*	0.3606*	0.3423*	0.3445*
Switzerland	0.2036*	0.2032*	0.1999*	0.1842*	0.1907*
Taiwan	0.1472*	1.4662*	1.3958*	1.2887*	1.3027*
Thailand	1.0455*	1.0555*	0.9749*	1.0139*	0.9585*
United Kingdom	0.2748*	0.2715*	0.2582*	0.2365*	0.2402*
United States	0.3013*	0.3002*	0.2974*	0.2486*	0.2872*

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 17: Abnormal Profits for Individual Countries After Risk Adjusted Net Profits to Relative Strength Indexes by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.3684*	0.3571*	0.3470*	0.3299*	0.3458*
Austria	0.2473*	0.2406*	0.2479*	0.2337*	0.2327*
Belgium	0.1492*	0.1496*	0.1502*	0.1420*	0.1575*
Canada	0.1530*	0.1543*	0.1582*	0.1358*	0.1514*
Denmark	0.1751*	0.1737*	0.1781*	0.1666*	0.1699*
France	0.2261*	0.2242*	0.2290*	0.2172*	0.2246*
Germany	0.3248*	0.3216*	0.3245*	0.3002*	0.3085*
Hong Kong	0.6693*	0.6410*	0.6560*	0.5714*	0.6335*
Italy	0.3680*	0.4530*	0.4356*	0.4240*	0.4145*
Japan	0.6531*	0.6219*	0.5980*	0.5192*	0.5354*
Malaysia	0.7919*	0.7453*	0.7087*	0.6502*	0.6199*
Netherlands	0.1299*	0.1306*	0.1363*	0.1273*	0.1475*
Norway	0.4247*	0.4121*	0.4030*	0.3677*	0.4006*
Singapore	0.4161*	0.4073*	0.3992*	0.3757*	0.3959*
South Africa	0.5318*	0.5107*	0.5192*	0.4608*	0.4545*
Spain	0.3383*	0.3228*	0.3249*	0.3115*	0.3171*
Switzerland	0.1470*	0.1510*	0.1596*	0.1511*	0.1617*
Taiwan	1.4211*	1.4182*	1.3615*	1.2601*	1.2833*
Thailand	0.9951*	1.0127*	0.9418*	0.9893*	0.9378*
United Kingdom	0.2127*	0.2162*	0.2136*	0.1986*	0.2081*
United States	0.2372*	0.2446*	0.2558*	0.2149*	0.2575*

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 18: Sensitivities to the 1-month Lagged Factor for Individual Countries by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0032	0.0027	0.0039	0.0036	0.0080*
Austria	-0.0047*	-0.0046*	-0.0038**	-0.0056*	-0.0050*
Belgium	0.0009	0.0013	0.0021	0.002	0.0024*
Canada	-0.0019	-0.0025**	-0.0026**	-0.0015	0.0019
Denmark	0.0011	0.0018	0.0004	0.0002	0.0007
France	0.0019	0.0006	0.0014	0.0022	0.0045*
Germany	0.0054*	0.0036	0.0054*	0.0048*	0.0069*
Hong Kong	-0.0052	-0.0066	-0.0064	-0.0049	0.0008
Italy	0.0023	0.0040	0.0059**	0.0060**	0.0068**
Japan	0.0030	0.0022	-0.0016	-0.0009	0.0121*
Malaysia	-0.0056	0.0005	0.0013	0.0095	0.0125
Netherlands	0.0011	0.0010	0.0018	0.0020	0.0028*
Norway	0.0021	0.0027	0.0002	0.0013	0.0012
Singapore	-0.0039	-0.0022	0.0027	0.0038	0.0081*
South Africa	-0.0042	-0.0034	-0.0025	-0.0009	0.0019
Spain	0.0016	0.0013	0.0009	0.0020	0.0038**
Switzerland	-0.0009	-0.0005	-0.0007	0.0024	0.0012
Taiwan	0.0023	0.0019	0.0127	0.0161**	0.0206*
Thailand	0.0118**	0.0118**	0.0159*	0.0137*	0.0192*
United Kingdom	-0.0012	-0.0013	-0.0012	-0.0006	0.0011
United States	-0.0027	-0.0007	-0.0021	-0.0027	0.0020

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 19: Sensitivities to the 3-month Lagged Factor for Individual Countries by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0015	0.0011	0.0011	0.0012	0.0012
Austria	0.0015	0.0017	0.0009	0.0003	-0.0006
Belgium	0.0004	-0.0002	-0.0005	-0.0005	-0.0002
Canada	-0.0026**	-0.0021	-0.0024**	-0.0019	-0.0016
Denmark	0.0011	0.0009	0.0004	0.0003	0.0003
France	0.0018	0.0013	0.0011	0.0011	0.0001
Germany	0.0011	-0.0008	0.0003	0.0040**	0.0026
Hong Kong	0.0006	0.0003	0.0020	-0.0029	0.0000
Italy	0.0007	-0.0018	-0.0018	-0.0006	-0.0007
Japan	0.0000	-0.0022	0.0024	0.0038	0.0033
Malaysia	-0.0101	-0.0087	-0.0061	-0.0039	-0.0034
Netherlands	-0.0017	-0.0019	-0.0031*	-0.0021**	-0.0019
Norway	-0.0005	-0.0004	-0.0032	-0.0024	-0.0016
Singapore	0.0003	0.0009	0.0024	0.0009	0.0025
South Africa	-0.0001	-0.0001	0.0010	-0.0011	-0.0013
Spain	0.0024	0.0021	0.0002	0.0003	-0.0013
Switzerland	-0.0003	-0.0006	-0.0012	-0.0009	-0.0020**
Taiwan	-0.0229*	-0.0229*	-0.0276*	-0.0233*	-0.0222*
Thailand	-0.0094	-0.0048	-0.0024	-0.0005	-0.0030
United Kingdom	0.0011	0.0007	0.0001	-0.0001	-0.0001
United States	-0.0019	-0.0027	-0.0023	-0.0027	-0.0014

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 20: Sensitivities to the 6-month Lagged Factor for Individual Countries by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0016	0.0020	0.0035	0.0019	0.0034
Austria	0.0049*	0.0037**	0.0029	0.0043**	0.0038
Belgium	0.0000	-0.0003	-0.0009	0.0002	0.0005
Canada	-0.0002	-0.0010	-0.0001	0.0007	0.0007
Denmark	0.0004	0.0011	0.0008	0.0013	0.0012
France	0.0012	0.0022	0.0011	0.0015	0.0011
Germany	0.0030	0.0027	0.0017	0.0029	0.0005
Hong Kong	-0.0040	-0.0057	-0.0061	-0.0051	-0.0067
Italy	-0.0050	0.0004	-0.0020	-0.0038	-0.0052
Japan	-0.0046	-0.0035	-0.0039	-0.0032	0.0001
Malaysia	0.0021	0.0023	0.0025	0.0005	0.0061
Netherlands	-0.0005	-0.0006	-0.0014	-0.0026*	-0.0018
Norway	0.0007	-0.0002	0.0003	0.0025	0.0022
Singapore	0.0029	0.0011	0.0014	0.0012	0.0010
South Africa	0.0026	0.0077*	0.0039	0.0067**	0.0087*
Spain	0.0006	0.0001	-0.0022	0.0004	-0.0013
Switzerland	-0.0003	-0.0001	0.0001	-0.0001	0.0004
Taiwan	-0.0026	-0.0083	0.0053	0.0065	0.0095
Thailand	-0.0047	0.0010	-0.0070	-0.0053	-0.0081
United Kingdom	0.0004	0.0009	-0.0004	-0.0004	-0.0017
United States	0.0013	0.0018	0.0011	0.0016	0.0011

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 21: Sensitivities to the 9-month Lagged Factor for Individual Countries by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	-0.0021	-0.0017	-0.003	-0.0019	-0.0024
Austria	0.0038	0.0033	0.0027	0.0033	0.0028
Belgium	0.0022**	0.0021**	0.0014	0.0001	0.0009
Canada	-0.0014	-0.0011	-0.0012	-0.0005	-0.0005
Denmark	-0.0006	-0.0008	0.0000	-0.0004	-0.0014
France	0.0016	0.0025	0.0019	0.0001	-0.0007
Germany	0.0022	0.0014	0.0019	0.0044**	0.0039**
Hong Kong	0.0029	0.0039	0.0007	0.0021	0.0030
Italy	0.0001	0.0024	0.0018	0.0022	0.0033
Japan	-0.0030	-0.0010	-0.0012	-0.0026	-0.0024
Malaysia	0.0152**	0.0139	0.0137	0.0115	0.0044
Netherlands	0.0032*	0.0015	0.0018	0.0011	0.0009
Norway	0.0011	-0.0001	0.0008	0.0012	0.0007
Singapore	-0.0004	-0.0016	-0.0018	-0.0016	-0.0016
South Africa	0.0026	0.0013	-0.0018	-0.0036	-0.0068**
Spain	0.0012	-0.0001	-0.0001	-0.0006	-0.0010
Switzerland	0.0004	0.0007	0.0006	-0.0004	-0.0007
Taiwan	0.0028	0.0054	0.0088	0.0063	0.0028
Thailand	-0.0035	-0.0020	0.0012	-0.0070	-0.0019
United Kingdom	0.0036*	0.0030**	0.0016	-0.0007	0.0004
United States	0.0052*	0.0052*	0.0056*	0.0055*	0.0044*

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 22: Sensitivities to the 12-month Lagged Factor for Individual Countries by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0010	0.0009	-0.0030	0.0016	0.0018
Austria	-0.0023	-0.0007	-0.0025	0.0047*	0.0041*
Belgium	0.0007	0.0009	0.0014	0.0011	0.0004
Canada	-0.0013	-0.0010	-0.0012	-0.0002	-0.0010
Denmark	0.0009	-0.0000	0.0000	0.0010	0.0016
France	0.0007	0.0004	0.0018	0.0015	0.0026
Germany	0.0021	0.0022	0.0019	0.0033	0.0032
Hong Kong	0.0041	0.0050	0.0008	0.0045	0.0022
Italy	-0.0019	-0.0004	0.0018	0.0016	0.0010
Japan	-0.0038	-0.0051	-0.0012	-0.0041	-0.0056
Malaysia	0.0133	0.0109	0.0138	0.0163**	0.0157**
Netherlands	0.0018	0.0023**	0.0018	0.0031*	0.0025**
Norway	0.0025	0.0030	0.0008	0.0045	0.0037
Singapore	-0.0027	-0.0014	-0.0018	-0.0034	-0.0052
South Africa	-0.0033	-0.0039	-0.0018	-0.0060*	-0.0063**
Spain	0.0016	0.0011	-0.0001	0.0034	0.0019
Switzerland	0.0002	-0.0004	0.0006	0.0000	-0.0004
Taiwan	0.0061	0.0012	0.0084	-0.0014	-0.0035
Thailand	-0.0091	-0.0037	0.0012	0.0015	0.0028
United Kingdom	0.0017	0.0027**	0.0016	0.0024	0.0031*
United States	0.0014	0.0005	0.0056*	0.0002	0.0016

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 23: Sensitivities to the 1-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0033	0.0026	0.0039	0.0038	0.0081*
Austria	-0.0045*	-0.0045*	-0.0040**	-0.0056*	-0.0047*
Belgium	0.0007	0.0008	0.0017	0.0022**	0.0024*
Canada	-0.0015	-0.0022	-0.0023	-0.0011	0.0018
Denmark	0.0010	0.0015	-0.0003	0.0003	0.0008
France	0.0015	0.0009	0.0011	0.0019	0.0044*
Germany	0.0054*	0.0032	0.0052*	0.0045*	0.0071*
Hong Kong	-0.0050	-0.0068	-0.0062	-0.0049	0.0009
Italy	0.0022	0.0041	0.0058	0.0061**	0.0068**
Japan	0.0028	0.0024	-0.0013	-0.0007	0.0120*
Malaysia	-0.0054	0.0003	0.0016	0.0093	0.0125
Netherlands	0.0011	0.0003	0.0017	0.0025**	0.0028*
Norway	0.0021	0.0025	0.0003	0.0012	0.0015
Singapore	-0.0035	-0.0024	0.0022	0.0036	0.0080*
South Africa	-0.0043	-0.0037	-0.0027	-0.0010	0.0018
Spain	0.0014	0.0010	0.0010	0.0020	0.0040**
Switzerland	-0.0010	-0.0009	-0.0007	0.0001	0.0010
Taiwan	0.0025	0.0017	0.0129	0.0160**	0.0205*
Thailand	0.0117*	0.0118**	0.0161*	0.0138*	0.0192*
United Kingdom	-0.0012	-0.0012	-0.0010	-0.0009	0.0011
United States	-0.0028	-0.0006	-0.0016	-0.0022	0.0023

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 24: Sensitivities to the 3-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0013	0.0011	0.0012	0.001	0.0014
Austria	0.0014	0.0011	0.0007	0.0001	-0.0007
Belgium	0.0001	-0.0002	-0.0005	-0.0006	-0.0002
Canada	-0.0023	-0.0021	-0.0023	-0.0016	-0.0014
Denmark	0.0005	0.0007	0.0003	0.0004	0.0005
France	0.0015	0.0010	0.0010	0.0011	0.0000
Germany	0.0002	-0.0010	0.0000	0.0045*	0.0030
Hong Kong	0.0002	0.0002	0.0019	-0.0030	0.0004
Italy	-0.0001	-0.0016	-0.0016	-0.0008	-0.0008
Japan	-0.0003	-0.0025	0.0024	0.0036	0.0032
Malaysia	-0.0099	-0.0081	-0.0061	-0.0036	-0.0036
Netherlands	-0.0025*	-0.0024**	-0.0028*	-0.0022**	-0.0020
Norway	-0.0007	-0.0007	-0.0034	-0.0022	-0.0015
Singapore	0.0005	0.0013	0.0027	0.0010	0.0028
South Africa	0.0001	-0.0002	0.0010	-0.0008	-0.0012
Spain	0.0024	0.0016	0.0002	0.0004	-0.0016
Switzerland	-0.0006	-0.0013	-0.0012	-0.0010	-0.0019
Taiwan	-0.0230*	-0.0230*	-0.0276*	-0.0233*	-0.0222*
Thailand	-0.0095	-0.0052	-0.0028	-0.0004	-0.0029
United Kingdom	0.0010	0.0006	-0.0001	0.0003	-0.0001
United States	-0.0018	-0.0031	-0.0022	-0.0027	-0.0014

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 25: Sensitivities to the 6-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0022	0.0020	0.0037	0.0018	0.0031
Austria	0.0045**	0.0033	0.0029	0.0041**	0.0038**
Belgium	-0.0001	-0.0004	-0.0010	0.0004	0.0006
Canada	-0.0003	-0.0011	-0.0002	0.0007	0.0008
Denmark	0.0005	0.0013	0.0009	0.0011	0.0012
France	0.0014	0.0023	0.0011	0.0013	0.0009
Germany	0.0028	0.0025	0.0017	0.0028	0.0006
Hong Kong	-0.0042	-0.0059	-0.0067	-0.0046	-0.0069
Italy	-0.0052	0.0004	-0.0018	-0.0039	-0.0049
Japan	-0.0045	-0.0034	-0.0036	-0.0035	-0.0002
Malaysia	0.0020	0.0021	0.0025	0.0002	0.0060
Netherlands	-0.0010	-0.0008	-0.0014	-0.0025**	-0.0022**
Norway	0.0008	-0.0001	0.0004	0.0027	0.0021
Singapore	0.0027	0.0011	0.0016	0.0014	0.0009
South Africa	0.0033	0.0077*	0.0043	0.0067**	0.0086*
Spain	0.0003	-0.0001	-0.0022	0.0003	-0.0011
Switzerland	-0.0006	0.0001	-0.0002	-0.0001	0.0001
Taiwan	-0.0023	-0.0081	0.0053	0.0069	0.0093
Thailand	-0.0048	0.0011	-0.0074	-0.0053	-0.0083
United Kingdom	0.0004	0.0009	-0.0008	-0.0003	-0.0020
United States	0.0013	0.0019	0.0011	0.0015	0.0008

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 26: Sensitivities to the 9-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	-0.0015	-0.0019	-0.0028	-0.0019	-0.0024
Austria	0.0039**	0.0036	0.0026	0.0030	0.0027
Belgium	0.0023*	0.0022**	0.0013	0.0000	0.0006
Canada	-0.0010	-0.0006	-0.0013	-0.0005	-0.0003
Denmark	-0.0007	-0.0006	0.0001	-0.0003	-0.0011
France	0.0017	0.0026	0.0019	0.0004	-0.0008
Germany	0.0024	0.0019	0.0024	0.0043**	0.0042**
Hong Kong	0.0035	0.0045	0.0007	0.0018	0.0036
Italy	0.0003	0.0024	0.0017	0.0027	0.0037
Japan	-0.0028	-0.0006	-0.0011	-0.0022	-0.0021
Malaysia	0.0152**	0.0137	0.0133	0.0116	0.0045
Netherlands	0.0032*	0.0017	0.0018	0.0006	0.0008
Norway	0.0011	-0.0004	0.0008	0.0011	0.0008
Singapore	-0.0008	-0.0019	-0.0019	-0.0017	0.0014
South Africa	0.0029	0.0018	-0.0016	-0.0036	-0.0069**
Spain	0.0012	-0.0001	-0.0003	-0.0004	-0.0004
Switzerland	0.0004	0.0006	0.0001	-0.0001	-0.0005
Taiwan	0.0029	0.0055	0.0085	0.0065	0.0028
Thailand	-0.0039	-0.0019	0.0009	-0.0069	-0.0019
United Kingdom	0.0031*	0.0029**	0.0018	-0.0007	0.0002
United States	0.0056*	0.0053*	0.0059*	0.0059*	0.0047*

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 27: Sensitivities to the 12-month Lagged Factor for Individual Countries after the Deduction of Transaction Costs by using Multivariate Regression Model

	7-day	9-day	14-day	21-day	28-day
Australia	0.0008	0.0009	-0.0028	0.0019	0.0018
Austria	-0.0025	-0.0009	0.0025	0.0048*	0.0041**
Belgium	0.0004	0.0009	0.0013	0.0009	0.0003
Canada	-0.0014	-0.0012	-0.0013	-0.0004	-0.0009
Denmark	0.0004	-0.0003	0.0001	0.0011	0.0019
France	0.0005	-0.0001	0.0018	0.0013	0.0023
Germany	0.0022	0.0022	0.0023	0.0032	0.0029
Hong Kong	0.0041	0.0048	0.0009	0.0044	0.0022
Italy	-0.0018	-0.0006	0.0018	0.0014	0.0009
Japan	-0.0037	-0.0055	-0.0011	-0.0042	-0.0054
Malaysia	0.0135	0.0110	0.0135	0.0164**	0.0157
Netherlands	0.0022**	0.0019	0.0018	0.0026*	0.0025**
Norway	0.0024	0.0029	0.0007	0.0048	0.0037
Singapore	-0.0024	-0.0012	-0.0019	-0.0033	-0.0049
South Africa	-0.0034	-0.0041	-0.0017	-0.0058	0.0062**
Spain	0.0015	0.0009	-0.0004	0.0033	0.0021
Switzerland	-0.0003	-0.0006	0.0001	0.0001	-0.0006
Taiwan	0.0060	0.0010	0.0081	-0.0018	-0.0032
Thailand	-0.0091	-0.0035	0.0009	0.0017	0.0024
United Kingdom	0.0017	0.0023	0.0017	0.0021	0.0030**
United States	0.0010	0.0004	0.0059*	0.0001	0.0010

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 28: A Comparison of the Profits from Momentum Strategies with the Profits from Relative Strength Indexes

Panel A: Total Average Profits from Momentum Strategies					
	1-week	**2-week**	**4-week**	**12-week**	**26-week**
π_t **(k)**	-0.0001	0.0032*	0.0008	0.0016**	0.0002
t-test	(-0.0993)	(3.4667)	(0.8365)	(1.9415)	(0.1727)
Net π_t **(k)**	-0.0272*	-0.0239*	-0.0264*	-0.0255*	-0.0266*
t-test	(-25.2226)	(-25.3007)	(-29.1088)	(-31.3770)	(-29.6141)

Panel B: Total Average Profits from Relative Strength Indexes					
	7-day	**9-day**	**14-day**	**21-day**	**28-day**
π_t **(k)**	0.0980*	0.0951*	0.0910*	0.0869*	0.0838*
t-test	(24.366)	(23.8501)	(22.8806)	(21.6564)	(20.7585)
Net π_t **(k)**	0.0893*	0.0875*	0.0852*	0.0822*	0.0799*
t-test	(22.2024)	(21.9636)	(21.4149)	(20.5041)	(19.7955)

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

Table 29: Average Profits from the Stochastic Relative Strength Index Implemented on International Stock Market Indexes

	7-day	9-day	14-day	21-day	28-day
π_t'	0.0744*	0.1045*	0.0935*	0.0915*	0.0864*
t-test	(18.0634)	(25.5873)	(23.2695)	(22.7319)	(21.5235)
Daily π_t'					
(in 100%)	1.4521*	2.0917*	1.8578*	1.8465*	1.7427*
t-test	(42.2510)	(66.5435)	(57.2401)	(56.1369)	(52.3596)
Net π_t'	0.0634*	0.0952*	0.0866*	0.0860*	0.0817*
t-test	(15.3755)	(23.3064)	(21.5844)	(21.3733)	(20.3867)
Net Daily π_t'					
(in 100%)	1.1403*	1.8289*	1.6675*	1.6919*	1.6122*
t-test	(32.5451)	(57.0904)	(50.8586)	(51.0652)	(48.1896)
Average Cost	0.0110	0.0093	0.0068	0.0055	0.0046
Aggregate Investment	8.0190	8.0163	8.0117	8.0100	8.0000

*significant at the 5% level for a two-tailed test

**significant at the 10% level for a two-tailed test

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